

WE CLAIM:

- 1 1. A self-carbonating cleaning solution prepared by combining
 - 3 a. an alkaline solution prepared by mixing a first acid, a first carbonate salt, and a first bicarbonate or percarbonate salt in water, so that the alkaline solution has a pH in the range of 9 to 11, and
 - 5 b. an acidic solution prepared by mixing a second acid, a second carbonate salt, and a second bicarbonate or percarbonate salt in water, so that the acidic solution has a pH in the range of 3 to 5;
- 7 wherein the alkaline solution reacts with the acidic solution to produce the self-carbonating cleaning solution having a pH of between 6 and 8 and carbon dioxide, and wherein the solids concentration in the self-carbonating cleaning solution is between about 1.0% to 5% by volume (1.5% to 4% by weight).
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- 1 2. The self-carbonating cleaning solution of Claim 1, wherein the first carbonate salt is selected from the group consisting of sodium carbonate, lithium carbonate, potassium carbonate, and ammonium carbonate.
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- 1 3. The self-carbonating cleaning solution of Claim 1, wherein the second carbonate salt is selected from the group consisting of sodium carbonate, lithium carbonate, potassium carbonate, and ammonium carbonate.
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- 1 4. The self-carbonating cleaning solution of Claim 1, wherein the first bicarbonate or percarbonate salt is selected from the group consisting of sodium bicarbonate, sodium percarbonate, lithium bicarbonate, lithium percarbonate, potassium bicarbonate, potassium percarbonate, ammonium bicarbonate, and ammonium percarbonate.
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1 5. The self-carbonating cleaning solution of Claim 1, wherein the second bicarbonate or
2 percarbonate salt is selected from the group consisting of sodium bicarbonate, sodium
3 percarbonate, lithium bicarbonate, lithium percarbonate, potassium bicarbonate,
4 potassium percarbonate, ammonium bicarbonate, and ammonium percarbonate.

1 6. The self-carbonating cleaning solution of Claim 1, wherein the first acid is selected
2 from a group consisting of citric acid, succinic acid, tartaric acid, adipic acid, glutaric
3 acid, and oxalic acid.

1 7. The self-carbonating cleaning solution of Claim 1, wherein the second acid is selected
2 from a group consisting of citric acid, succinic acid, tartaric acid, adipic acid, glutaric
3 acid, and oxalic acid.

1 8. The self-carbonating cleaning solution of Claim 1, wherein the first and second
2 carbonates are sodium carbonate, the first bicarbonate or percarbonate is sodium
3 bicarbonate, the second bicarbonate or percarbonate is sodium bicarbonate, and the
4 first and second acids are citric acid.

1 9. The self-carbonating cleaning solution of Claim 1, wherein the acidic solution is an
2 acidic partially-carbonated pre-spray solution that is prepared by mixing by volume
3 about 10 to 30 ml of the first carbonate salt, about 30 to 50 ml of the first bicarbonate
4 or percarbonate salt, and about 300 to 325 ml of the first acid, so that the acidic
5 solution has a pH of about 4, whereby the acidic solution may be used separately for
6 either pre-treatment of heavily soiled textile fibers or for a component of the self-
7 carbonating cleaning solution.

1 10. The self-carbonating cleaning solution of Claim 9, wherein the first carbonate salt is
2 20.9 ml of sodium carbonate, the first bicarbonate or percarbonate salt is 41.6 ml of
3 sodium bicarbonate, and the first acid is 312.5 ml of citric acid.

1 11. The self-carbonating cleaning solution of Claim 1, wherein the alkaline solution is an
2 alkaline partially-carbonated pre-spray solution that is prepared by mixing by volume
3 about 90 to 120 ml of the second carbonate salt, about 190 to 220 ml of the second
5 bicarbonate or percarbonate salt, and about 50 to 70 ml of the second acid, so that
7 the alkaline solution has a pH of about 10, whereby the alkaline solution may be used
 separately for either pre-treatment of heavily soiled textile fibers or for a component
 of the self-carbonating cleaning solution.

1 12. The self-carbonating cleaning solution of Claim 11, wherein the second carbonate is
2 about 104.1 ml of sodium carbonate, the second bicarbonate or percarbonate is 208.4
3 ml of sodium bicarbonate, and the second acid is 62.5 ml of citric acid.

1 13. A method of cleaning textile fibers using an application device having a first removable
2 tank and a second removable tank, the method comprising
3 a. providing an alkaline partially-carbonated pre-spray solution having a pH of
 about 10 in the first removable tank;
5 b. providing an acidic partially-carbonated pre-spray solution having a pH of about 4
 in the second removable tank;
7 c. selectively pre-treating portions of the textile fibers with the acidic partially-
 carbonated pre-spray solution;
9 d. selectively pre-treating portions of the textile fibers with the alkaline partially-
 carbonated pre-spray solution;
11 e. combining the alkaline partially-carbonated pre-spray solution in the first
 removable tank and the acidic partially-carbonated pre-spray solution in the

13 second removable tank through use of a mixing means associated with the
application device to provide a self-carbonated cleaning solution having a pH in
15 a range between 6 and 8; and

17 f. cleaning the textile fibers with the self-carbonated cleaning solution;
wherein the removable tanks remain on the device and are not replaced with
removable tanks containing different pre-spray solutions.

1 14. The method according to Claim 13, wherein alkaline partially-carbonated pre-spray
solution is a mixture by volume of about 90 to 120 ml of a carbonate salt, about 190
3 to 220 ml of a bicarbonate or percarbonate salt, and about 50 to 70 ml of an acid, in
solution with a sufficient amount of water so that the mixture has a pH of about 10.

1 15. The method according to Claim 13, wherein acidic partially-carbonated pre-spray
solution is a mixture by volume about 10 to 30 ml of a carbonate salt, about 30 to 50
3 ml of a bicarbonate or percarbonate salt, and about 300 to 325 ml of an acid, in
solution with a sufficient amount of water so that so that the mixture has a pH of
5 about 4.

1 16. The method according to claim 13, wherein the mixing means is a compression tee
fitting that combines equal portions of the alkaline partially-carbonated pre-spray
3 solution and the acidic partially-carbonated pre-spray solution.

1 17. The method according to claim 13, wherein the mixing means is a valve that combines
selected ratio of the alkaline partially-carbonated pre-spray solution and the acidic
3 partially-carbonated pre-spray solution.

1 18. The method according to claim 13, wherein the mixing means is a first valve
controlling the alkaline partially-carbonated pre-spray solution and a second valve

3 controlling the acidic partially-carbonated pre-spray solution, wherein the amounts of
each pre-spray solution combining to provide the self-carbonated cleaning solution are
5 separately selectable.

1 19. A system for cleaning textile fibers comprising
3 a. an application device having a first removable tank containing an alkaline partially-
carbonated pre-spray solution having a pH of about 10 and a second removable
5 tank containing an acidic partially-carbonated pre-spray solution having a pH of
about 4;

7 b. a means for delivering the alkaline partially-carbonated pre-spray solution for pre-
treatment of a first selected area of textile fibers;
9 c. a means for delivering the acidic partially-carbonated pre-spray solution for pre-
treatment of a second selected area of textile fibers; and
11 d. a mixing means for proportionately combining the contents of the tanks to provide
a self-carbonated cleaning solution.

1 20. The system described in Claim 19, wherein the mixing means is a compression tee
fitting that combines equal portions of the alkaline partially-carbonated pre-spray
3 solution and the acidic partially-carbonated pre-spray solution.

1 21. The system described in claim 19, wherein the mixing means is a valve that combines
selected ratio of the alkaline partially-carbonated pre-spray solution and the acidic
3 partially-carbonated pre-spray solution.

1 22. The system described in claim 19, wherein the mixing means is a first valve controlling
the amount of the alkaline partially-carbonated pre-spray solution provided to a first
3 port of a compression tee and a second valve controlling the amount of acidic
partially-carbonated pre-spray solution provided to a second port of the compression

5 tee, the compression tee providing a mixture of the pre-spray solutions through a third
port, wherein the amounts of each pre-spray solution combining to provide the self-
7 carbonated cleaning solution are separately selectable.